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Agenda Item: C.5.1

Iran

THE CONTRIBUTION OF IRAN IN COMBATING A RECENT EPIZOOTIC OF AFRICAN HORSESICKNESS IN THE MIDDLE EAST

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The contribution of Iran in combating recent epizootic of African Horsesickness in the Middle East

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Introduction

In the summer of 1959 a fatal disease broke out in the South Eastern regions of Iran and caused some mortality among horses. This disease which was unknown in the country was taken under consideration and systematic study. In the meantime the disease was reported by veterinary services of the neighbouring countries and from samples submitted by Pakistan government to the Onderstepoort Laboratory, an African Horsesickness virus was isolated.

The spread of this outbreak was not so extensive and it subsided in all the affected areas in the winter of 1959.

In the spring of the following year, the weather being hot and humid in the Southern part of Iran, outbreaks of the disease were reported to be much more intense and spreading in all over Persian Gulf areas. Immediately a group of Razi Institute workers and the field veterinarians were sent to that part and the result of their clinical and post-mortem examination showed undoubtedly the disease to be African Horsesickness. This was reported to the Ministry of Agriculture and O.I.E. in April 1960.

To confirm the diagnosis, adequate blood samples from the affected animals were sent to the Onderstepoort Laboratory, South Africa, and to the Razi Institute, Hessarak, Iran.

The first attempt to isolate the virus at the Razi Institute proved successful and the virus was isolated in May 1960.

Meanwhile information was received from the Onderstepoort Laboratory confirming the presence of the A.H.S. virus in the submitted blood samples.

Confirmation of the presence of Horsesickness in Iran as well as in Pakistan, Afghanistan, India, Turkey, in this time, made this disease a subject of great importance as regard to its international and economical aspect.

The necessary information was collected, in Razi Institute, about the different aspect of the disease in order to work out an efficient vaccine for its control.

Fortunately at this stage the Food and Agriculture Organization of the United Nations decided to send Dr. Howel, an expert on A.H.S. from the Onderstepoort Laboratory, to Iran, to conduct a training course concerning Horsesickness at Razi Institute in which representatives from India, Iraq, Pakistan, Afghanistan, Turkey, Jordan, Syria and Iran took part.

In addition to the technical demonstrations and lectures given during this course, an ideal opportunity presented itself to discuss the general problem of the disease in this area. These discussions gave rise to an interesting exchange of views and emphasized the need for international co-ordination to put into effect the basic sanitary policies to prevent further spread of the disease.

During this period the disease progressed rapidly over the infected areas and gradually appeared in the countries besides the above mentioned

ones, so that by October 1960 all countries stretching from Turkey to India, having a horse population of about 13,000,000 were overrun with the disease.

Such being the case, in 1960, all countries in this area were turned into a vast combating zone to control and eradicate the disease. Sanitary control measures were applied and a mass vaccination carried out.

Although the cost of this campaign was heavy and thousands of soliped animals were lost, nevertheless the result was satisfactory, the disease, more or less, came under control and the danger of its spreading into Europe passed.

Horsesickness was probably introduced to the Middle East via the Persian Gulf and Arabian peninsula. The mode of transmission of the disease from the enzootic region in Africa to these new foci has not been definitely determined, but introduction of the infected animals or infected vectors by means of sea or air transport must not be overlooked.

The appearance of A.H.S. in this part of the world, as well as its occurence in Palestine, Lebanon and Syria, in 1944, shows that the disease, which is usually regarded as being confined to the continent of Africa can appear in any part of the world where the climatic and possibly other conditions are favourable for the insect vectors of this disease. This outbreak also strasses, once more, the fact that the danger to the unaffected countries has not been erased and in the future, as McIntosh anticipated in 1958, "...outbreaks may well occur in continents hitherto free from the disease..." and that in this case the importance of increasing our knowledge of this disease should not be overlooked.

The nature of the disease and its present distribution

Horse sickness is an epizootic, insect-born, infectious disease of equine animals characterized by hyperthermia, cardiovascular changes, pulmonary and subcutaneous oedema. Clinically A.H.S. may be divided into four distinct forms: cardiac, pulmonary, mixed and horsesickness fever. Thecardic form predominated in the recent outbreak in the Middle East.

The disease has been known in South Africa for many centuries and now it is widely distributed in the continent of Africa and in Cyprus, Afghanistan, India, Iraq, Iran, Jordan, Lebanon, Pakistan, Turkey and Syria.

In Africa the disease is found only in certain localities, occurring under definite telluric and climatic conditions (Henning 1949).

Informations concerning A.H.S. in Asia is sufficiently comprehensive to show that the climatic and environmental conditions are closely related to onslaught and disappearance of the disease as it has been found in Africa.

The similarity is seen at first in the appearance of the disease in the hot humid climate of the Persian Gulf during the spring, its spreading nature throughout the hot summer season, and its negligible incidence during the cold winter months. It was also noted that the horses kept housed in mosquito-proof stablesand those moved to high mountainous pastures were not affected by the disease.

Horsesickness is caused by a filtrable virus which is present, in a high concentration, in the blood during the febrile stage, and it also exists in the internal organs and tissue fluids of the affected animals.

There exists an antigenic plurality of strain of H.S. virus (Alexander 1935) McIntosh 1958, using 42 strains, showed that these strains could be grouped in 7 main immunological types. The virus can be isolated from infected materials by intracerebral injection of baby or adult mice. The virus as isolated from the equine cases, has viscerotropic properties which can be demonstrated by the inoculation of susceptible solipeds. In addition to horses, mules and donkeys; dogs and goats are readily infected, either by injection (goats and dogs), or by feeding on infected meat (dogs). The virus in these animals keeps its viscerotropic nature.

In 1932 Nieschultz reported the susceptibility of the white mice to the virus by intracerebral route and this was confirmed later on by Alexander in 1933. Alexander also recorded the full susceptibility of the guinea-pig and rat to the virus and offered a valuable technique for the neurotropic fixation and attenuation of the virus. McIntosh, in 1958, showed that ferret, being susceptible to the viscerotropic virus, is the most suitable laboratory animal for isolation of A.H.S. virus from previously immunized sick horses.

Adult mice are the most suitable animals for neurotropic fixation of Horsesickness virus. These animals when injected intracerebrally, become easily infected. In the first two or three passages the virus is not virulent enough to cause a high mortality in mice, i.e. only some of the inoculated mice show the symptoms of the disease and the incubation period may be prolonged up to three weeks or more. As the serial passages progress the virus becomes adapted and accustomed to neurotropic propagation and the incubation period decreases gradually so that after a few passages the mortality is usually 100 per cent and the interval between injection and death reaches a constant minimum, (4-5 days).

Apparently the virulence increase of the virus for mice corresponds to the decrease of its virulence in horses, so that through successive passages the virus loses its pathogenicity for solipeds without losing its antigenic and immunizing potentialities.

The neurotropic virus is pathogen to mice, guinea-pigs, and rats and the only satisfactory method of infecting is by direct intracerebral injection. In these animals the disease assumes neurotropic characteristics exclusively and the virus multiplies, remaining concentrated in the brain. The neurotropic virus does not produce a specific encephalitis or mortality in horses even by intracerebrally inoculation. The virus keeps its neurotropic nature and after at least one passage in equines, retains its attenuation, (Alexander, 1935).

A locally isolated virus has recently been adapted to the primary hamster kidney cells in Razi Institute, (Mirchamsy and Taslimi, 1962). The pathogenicity of the adapted virus, for mice, seems to be slightly decreased after 12 serial passages, (Mirshamsy, unpublished).

Sanitary measures and prevention

Although stabling susceptible animals during night, moving them to areas free from the disease or to high mountainous pastures, application of insecti - sides destruction of affected animals and isolation of the infected zone by quarantine regulations, and so on, help to prevent the introduction of carriers from infected to clean areas, and to protect individual animals; it is absolutely impractical to depend on these measures on a large scale basis.

Therefore, in order to prevent, control and eradicate the disease and to build up an immune equine population in an affected area, besides the above sanitary measures, an annual mass vaccination scheme of solipeds by a suitable vaccine is of absolute necessity. Among the different methods of vaccination, use of the neurotropic polyvalent vaccine has so far yielded the best result.

Neurotropic polyvalent vaccine

The polyvalent neurotropic H.S. vaccine, prepared at the Razi Institute according to the technique developed in Onderstepoort Laboratory, consists of pooled culture materials of 6 attenuated antigenically different H.S. virus strains propagated in mice brain. Each of these 6 virus strains which we call vaccine strains, is a virulent H.S. virus of the field having undergone a complete attenuation through one hundred or more intracerebral passages into adult mice.

These vaccine strains were kindly supplied by the Onderstepoort Laboratory and adequate numbers of freeze-dried ampoules were prepared from each after 2 passages in adult mice.

To prepare the vaccine, each vaccine strain has to be separately treated as follows: 10-20 mice are injected intracerebrally by reconstituted freeze-dried ampoule of the vaccine strain in 10 per cent horse or rabbit serum saline. After an incubation period of 3-4 days, the mice , while in extremis, are killed by etherization and the brain tissue harvested. A ten per cent suspension is then prepared from the infected mice brain in serum saline. The supernatant of this suspension after centrifugation at 3000 r.p.m. for 30 minutes and testing for bacteriological sterility, is used as the working seed virus which can be kept at 4 c. for a few months.

To propagate the virus in mice brain, the required number of Swiss Albino adult mice are injected intracerebrally by 0.05 ml. of diluted working seed virus in serum saline. The mice are kept in suitable cages, labelled with the type of virus, the number of inoculated mice contained in the cage and the date of inoculation, under close observation. The incubation period in mice varies between 60 and 96 hours according to the strain of virus.

The disease which is exclusively neurotropic appears in different forms depending mainly on the amount of inoculated virus and somewhat on the type of the virus itself. The sick mice, while in extremis, are etherized and then pinned on a dissection board with their backs uppermost. Each mouse is saturated with surgical alcohol. With a sharp pair of scissors and forceps the skin covering the wither and cranium is removed exposing the skull which is again sprayed with alcohol. Using a sterile straight-pointed pair of scissors and forceps, the calvaria is cut and pushed upwards and the brain removed on the point of the scissors. The harvested brains are put in a suitable sterile tube, which is labelled, stoppered and stored at -20°C until required.

As mentioned before the vaccine is a polyvalent one, incorporating 6 different virus strains. Therefore, the infected mice brain of all different types of virus are added in equal amount in the vaccine. The desired amount of infected brain (6 x n) is collected from deep-freeze, allowed to thaw, mixed and then macerated in an Atomix apparatus with sufficient chilled distilled water for 2-3 minutes. The resultant fine suspension is diluted with chilled distilled water and buffered-Lactose-Peptone solution so that the volume of each one of the distilled water and buffer added to the brain tissue reaches (5 x 6 x n) ml.

Penicillin, 1.000 units and streptomicin, 1 Milgm. per ml. of the final suspension are added. This virus suspension which should be bacteriologically sterile is the A.H.S. vaccine.

The vaccine is distributed in bottles and then freeze dried in a Stockes machine. The bottles containing the dessicated vaccine are evacuated, stoppered, sealed and random samples from each batch are then taken for final titration in mice, bacteriological sterility and the safety tests. When the results of these tests are satisfactory, the bottled vaccine is labelled and stored at 4°C. till the time of distribution (Rafyi, 1961, -Hazrati, 1961).

The vaccine at Razi Institute is actually issued in 25 c.c. bottles containing each 5 doses of freeze dried material. Each vaccine dose contains not less than 20,000 mouse m.l.d. of virus from each one of the six nuerotropic strains. The dose is the same for mule, horse and donkey no matter what age, size or breed. The vaccine must be transported in iced thermos flasks, wherever possible and must be stored in a refrigerator. It should be used as soon as possible, but not after a lapse of four weeks from the time of its removal from the refrigerator, and in this interim it must be stored in a dark cool place.

More than 1,600,000 doses of polyvalent neurotropic vaccine have been prepared at Razi Institute, since May 1960. Part of this amount of vaccine has been used inside the country and the remaining 650,000 doses, issued to the following neighbouring countries; free and reduced to Afghanistan, at reduced cost to Pakistan and at cost price to others:

Name of the country	Amount of the vaccine
Turkey	375,000 doses
Pakistan	21,500 "
Afghanistan	77,000 "
Syria	30,000 "
India	30,000 "
Cyprus	51,000 "
Jordan	29,000 "
Lebanon	5,000 "
Iraq	30,000 "
Others	1,500 "
Total	650,000 doses

As by the time of the disease onset, there was no, or not enough, facility for preparing the vaccine in the above mentioned countries; the importance of the Tazi Institute's contribution in providing the necessary vaccine for the disease campaign in this part of the world can be realized.

Vaccination

The vaccine contained in each bottle must be dissolved in 25 ml. sterile saline, and as the vaccine loses its activity very rapidly after being dissolved, this must be done immediately before use. The vaccinal dose is 5 ml. of dissolved vaccine, given subcutaneously.

The solipeds can be inoculated at any age. Mares may be inoculated two weeks before and after foaling, and foals from immune dams should not be vaccinated before seven months old. Livestock owners are advised to rest their vaccinated animals for 3 weeks following inoculation.

Among the military horses and mules, and those of the Razi Institute, where this advice has been followed, no severe post vaccination-reaction except the rise in temperature on about the seventh day after vaccination has been seen.

However, a severe reaction due to H.S. vaccination has been reported from the field showing in many cases a mortality varying from 0.1. per cent of vaccinated animals in horses to 5 per cent in donkeys. This high accident rate, especially in donkeys, encountered with the use of polyvalent neurotropic vaccine, caused much difficulty in combating and eradicating A.H.S. in the Middle East. Some work has been done to clarify the causes of this severe post-vaccination reaction, which occurs particularly in donkeys, but the result has not been satisfactory. (Hazrati,1961).

Immunity

The reports received from the field, although limited, are sufficiently comprehensive to show that the vaccination results, even under field conditions, have so far been satisfactory.

The immunity is easily demonstrable four weeks after vaccination and is durable for at least one year. The neutralization index of several sera, 3-4-5 months after being vaccinated, was found to be about 100 against type six, one of the six vaccine strains taken as an example. This titre indicates that a solid and complete immunity develops 3-5 months after vaccination (Hazrati 1962).

The occurence of the disease among the vaccinated horses, especially inside and around the infected area where the disease is active, must be attributed to this slow immunity development. It is worth noting that no single case of H.S. has been seen, among the military horses and those of the provinces far from the affected area, after immunization in Iran. Nearly the same result has been obtained from the other affected countries confirming that this vaccine is the most satisfactory one for practical and economical purposes and affords adequate immunity against the virus strains present in this part of the world. The virus strain isolated at Onderstepoort Laboratory from a blood sample received from Pakistan was found to have an antigenic similarity with type six of H.S. virus. This has also been shown by cross immunization in Iran, using a local Iranian strain (Rafyi,1961). Later on by "intracerebral neutralization test in mice", using 5 mouse adapted local strains, selected from a total of 53 strains isolated in Iran, the same result was obtained. As this antigenic relation was not complete, it was decided to use a local strain in polyvalent vaccine. Strain S2 was selected for this purpose and it was found to be fully attenuated, possessing relatively a good immunizing potentiality at its 65th generation in adult mice, (Hazrati & Taslimi). This strain will be incorporated into the present polyvalent vaccine in the future in order to increase the value of the vaccine.

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SUMMARY

1. A brief account is given of the epizoology of African Horsesickness and the recent outbreak of the disease in the Middle East.

2. The nature of the disease and its present distribution is discussed. Attention is paid to the types of the strains of virus isolated in Iran which was found to be closely related to type 6.

3. The value of vaccinating solipeds, using polyvalent neurotropic vaccine, to control the disease in the recent outbreak is shown.

4. Details of the technique employed for the preparation of polyvalent neurotropic vaccine at Razi Institute, Iran, are given.

5. It is mentioned that a locally isolated strain has been fully attenuated, possessing relatively a good immunizing potentiality, and that this attenuated strain will be, in the future, incorporated into the present polyvalent vaccine in order to increase its potency for the equine population of this part of the world.

6. The contribution of Iran in the disease campaign, in the Middle East, either by organization of the special training course concerning horsesickness, at Razi Institute, or by providing the necessary vaccine to help the neighbouring countries are described.

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UTILISATION OF UNUSED PROTEIN RESOURCES FOR HUMAN FEEDING

by
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1. The significance of protein malnutrition in developing countries

The unfortunate social and economic consequences of under-nutrition and malnutrition in large segments of the populations of the developing countries are now clearly recognized. The consequences of impairment of nutritional health may include lowered vitality, impaired intelectual and physical productivity, increased susceptibility to diseases, and other undesirable manifestations. In spite of this general recognition of the importance of satisfactory nutritional status, the extent to which under-nutrition and malnutrition of infants and young children is related to an inadequacy of the supply or use of protein-rich foods does not seem to have been adequately appreciated. This problem is particularly acute in the tropical and sub-tropical areas. Nutrition research has shown a direct connection between protein inadequacy in the diets of weanlings and toddlers and the very high death rates of children in the one to four year age group in several countries. The probability that much more can be done to meet these needs by pressing into use local protein resources now not used as food also merits wider recognition.

Increased comprehension is needed at planning levels of governments, that the general assurance of adequate nutritional status cannot come about by placing emphasis solely on increased production of traditional calorie-rich staples such as maize, rice, cassava, bananas or even wheat. Infants and young children experience the most rapid stage of human growth, thus requiring dietary protein for tissue building of a quantity and quality considerably in excess of that provided by diets restricted to these common food staples. The supplementation of these diets by animal protein, - best of all milk, - and by pulses is most desirable. However, a major problem in many tropical and sub-tropical countries is that such foods may be in short supply and the possibility for augmenting their production may, for various reasons, also be limited or be, at least, a slow process.

2. The problem of low-protein food staples

A clearer understanding of the problem can be gained by examining the protein levels of the world's primary foods, with particular attention to the staples used in the tropics and sub-tropics as shown in Table 1.

Table 1. Average Protein Content of Selected Foods

(Expressed as percent, N x 6.25, air dry or "as processed")

Foods of animal origin		Cereals	
Whole milk	26.1	Wheat flour	11.5
Skim milk	35.0	Rice (brown)	7.2
Beef	64.8	Rice (polished)	7.0
Whole egg	47.0	Maize meal (whole)	9.4
Cod, salted	81.8	Maize meal (degerm.)	7.9
		Sorghum meal	8.8
Oilseeds and pulses			
Broad bean	24.0		
Chickpea	18.2	**Starchy roots and fruits**	
Garden pea	22.5		
Kidney bean	22.0	Cassava (manioc)	1.7
Lentils	23.7	Potato	6.4
Peanuts	26.7	Sweet potato	1.6
Sesame seed	17.6	Banana	1.8
Soybeans	33.4	Plantain	2.8

The widely used "weaning foods" such as cassava, bananas and sweet potatoes are extremely low in protein. Even the major cereals, rice, maize and wheat do not provide adequate levels of protein, either in quality or quantity, within the maximum levels which weanlings and toddlers can consume.

It has always been true that the total consumption of protein, and indeed the percentage of high quality protein from animal sources, varies with family and economic status. At the national level, it also varies with the degree of economic development. This relationship is shown in Table 2.

Table 2. Average Calories and Proteins Available per Person per Day, 1958-59

Developed countries	Calories	Proteins	
		Total, g	Animal, g
Australia	3200	91	60
United Kingdom	3260	85	50
United States	3100	93	65
Under-developed countries			
India	1800	47	6
Mexico	2250	58	13
U.A.R.(Egypt)	2590	77	15

3. New protein resources

It is for these reasons that considerable interest is being directed towards utilising as food in countries chronically deficient in animal protein the indigenous protein resources such as the oilseed meals and presscakes as well as fish flour, all of which have been little used previously as human foods. The widespread availability of these materials, particularly in many tropical and sub-tropical countries, suggested to food authorities that these protein resources could be brought into use as economical protein supplements well in advance of more novel and longer-range possibilities such as the proteins from algae, yeast, green leaves, mushroom mycelia and plankton, for which adequate technology does not now exist.

The protein-rich residues of peanut, cottonseed, soybean, sesame and copra (desiccated coconut meat) have been traditionally used as fertilizers or as animal feed. The proposal that they be utilised as foods for infants and children, notwithstanding the extensive literature on their feeding value for animals, prompted searching questions from human nutritionists and pediatric clinicians. These doubts have now been mostly dissipated as a result of a five-year international research programme assisted by the Rockefeller Foundation. Last year, the research reports of 26 nutrition research workers and their pediatric collaborators were published indicating the remarkable usefulness of plant proteins in infant and child feeding, particularly when they are combined with each other and with the locally used calorie-rich staple foods to produce the best possible amino acid patterns. Based on these and other clinical and nutritional studies, practical feeding programmes have been already initiated in several countries. Oilseed protein residues are being used in most of these programmes. Continuing surveillance of the clinical, pediatric and food safety aspects of the programme is provided by the WHO/FAO/UNICEF Protein Advisory Group, a committee of internationally recognized nutritionists, clinicians and pediatricians. This Group, in cooperation with specialists in many countries, evolved a number of criteria for processed high-protein foods which include the following requirements:

(a) the material used must be available locally or be suitable for local production;

(b) the purchase of the processed food must be within the economic means of the particular population group requiring it;

(c) they must be easily transportable and have a long storage life under tropical conditions;

(d) they must be free of any toxic or other deleterious influence;

(e) they must have such nutritional value as to be an effective protein supplement; and

(f) they must be acceptable to the local population.

4. The possible impact of oilseed residues on protein needs

The quantitative role which oilseeds might play in meeting the world's protein food shortage is indicated in Table 3 which presents a recent estimate of world oilseed production. Soyabean, cottonseed and peanut are the largest

Table 3. World Production of Oilseeds, 1958

	Million tons
Soybeans	28
Cottonseed	19
Peanut	14
Copra	3
Sesame	2
Sunflower	2

oilseed crops. The potential nutritional impact of some of these resources in specific under-nourished countries where they are available is indicated in Table 4.

Table 4. Oilseed Protein potentially available

grams/person/day

Peanuts		Cottonseed		Copra	
Nigeria	10	Egypt	17	Philippines	6
India	5	Mexico	13		
		Brazil	8		
		Turkey	6		

The impact can be best estimated on the basis of optimum human protein requirements which have been suggested to range from 40 to 70 grams per person per day.

5. The role of Governments and WHO/FAO/UNICEF in protein-rich food Projects

In order to assist interested Governments to initiate, organize and carry forward protein-rich food programmes based on wider utilisation of local protein resources, the United Nations Agencies WHO, FAO and UNICEF initiated some eight years ago a joint programme to co-ordinate, develop and disseminate available nutritional and technological knowledge in this field. Through this programme, material assistance is available to Governments for acceptability testing and local processing of suitable foods as well as for their introduction into national food economies. Within the framework of a UNICEF/FAO-assisted protein-rich foods programme, specialized training of government-sponsored scientists can be provided, and the services of international advisors to assist the national effort can be furnished.

It is the responsibility of Governments to initiate such programmes by requests through the usual channels. A responsible Government agency must be prepared to assume active leadership of a broad national scheme which would include the co-ordinated efforts of local industry, extension services, welfare agencies and voluntary organizations. These programmes are aimed at establishment of acceptance and development of continuing demand for protein-rich foods by the people. One of the ultimate objectives of course is to make such products available to low income families through normal marketing channels.

6. Progress in the utilisation of oilseed and fish protein concentrates

One of the most encouraging prospects is the wider utilisation of soybean as a protein resource. In Indonesia, UNICEF and FAO have assisted the Government to bring into operation a plant producing a spray-dried extract ("milk") from soybean and sesame, known locally as Saridele, which has gained good acceptance and an increasing demand. This plant is now operated commercially. Much attention is being given in Taiwan, Brazil and Indonesia to the development of new soy food formulations with heat-processed full-fat whole-soybean products which appear to be of higher nutritional value and lower in cost of production than the extracted spray-dried beverages. UNICEF is also sponsoring research and development to improve the technology of certain traditional fermented soy foods, including tempeh, a mould-processed product popular in Indonesia, which may be also useful for the production of infant foods. The composition of some typical dry soy food products, including one of the new isolated protein materials, is shown in Table 5.

Table 5. Composition of some typical dry soy foods

	Beverage powders				
	Defatted heated soy flour	Full-fat heated soy flour	Based on full-fat soy flour	Saridele	Protein isolate
Protein (N x 6.25),%	52.0	43.0	29.0	29.1	88.5
Fat, %	1.5	22.0	16.0	18.2	0.1
Fibre, %	3.2	2.0	1.6	0.5	0.7
Ash, %	5.8	4.2	5.0	4.2	2.4
Carbohydrates, %	33.2	25.0	45.0	44.0	-

Food-grade defatted peanut flour also offers considerable potential. UNICEF is presently assisting the Government of India to bring into production the first commercial plants to provide edible peanut flour with protein content of 45% or more. The major application will be as a supplement to wheat flour and for infant food formulations. In Nigeria, peanut flour supplemented with skim milk (4:1) is being introduced and has been shown to have nutritive and therapeutic value essentially equivalent to that of skim milk in treatment of kwashiorkor. In Senegal, FAO and UNICEF are co-operating in the promotion of millet foods supplemented with locally produced peanut flour. Brazil also has achieved considerable production of peanuts, and a solvent-defatted locally made product has been utilised in school lunch feeding.

Recently, toxins of fungal origin have been shown to occur in some lots of low-grade animal and fertilizer-grade peanut presscakes moving in international commerce. This observation has raised considerable apprehension concerning the safety of peanut foods. Fortunately, techniques have been developed in British laboratories to screen peanuts for freedom from this factor. FAO and UNICEF are reacting to this problem by providing training grants to scientists involved in national efforts to process and introduce peanut flour as food, in order that they may initiate such screening methods in their home countries. This will permit full resumption of these introductory and food promotion efforts. Some chemical analyses of peanuts, peanut flours and protein isolates from peanuts are indicated in Table 6.

Table 6. Results of Chemical Analyses of Peanuts, Peanut flours and Protein Isolates of different origin

Source	Process	Moisture %	Protein N x 6.25 %	Fat %	Ash %	Crude Fibre %
Peanuts						
Senegal	-	5.5	26.8	41.7	2.1	5.4
Flours						
Georgia, USA	Expeller	8.6	52.6	5.6	4.3	3.6
Senegal	"	7.4	43.9	4.5	3.4	4.3
India	"	10.0	46.0	8.0	5.0	2.1
Brazil	Solvent	5.4	63.5	3.1	4.6	3.3
Isolates						
Mysore, India	Dispersion	4.7	90.0	4.2	1.1	-
B.C.and C., UK	Impulse	8.0	93.0	1.0	1.5	-
"Lypro", UK	"	3.0	68.0	27.0	1.0	-

Suitably processed cottonseed flour is already finding acceptance in food mixtures in Central and South America. This progress is mostly the result of the pioneering nutrition and food formulation efforts of the Institute of Nutrition of Central America and Panama (INCAP). Table 7 shows typical chemical values for

Table 7. Composition of some Cottonseed Protein Products

	Edible defatted flour	Solvent-degossypolized meals		INCAP formula 9B
		Sicily	U.S.	
Protein (N x 6.25), %	51.3	54.1	51.0	27.5
Fat, %	5.2	1.0	0.6	4.2
Fibre, %	3.7	4.3	7.1	2.4
Ash, %	6.6	-	7.0	3.5
Carbohydrates, %	30.0	-	24.4	54.8
Total gossypol, %	0.92	0.26	0.1	-
Free gossypol, %	0.045	0.03	0.03	-
Lysine				
Total, % of protein	4.1	-	-	3.5
Available, % of protein	3.6	3.4	3.1	-

various cottonseed products processed as food, as well as that of Incaparina (Formula 9B) which is a low-cost mixture of expeller-processed edible cottonseed flour, corn and mineral and vitamin additives which has been used with remarkable effectiveness in treating protein malnutrition in infants and children. The success of this clinical experience has established the acceptability as food for infants of cottonseed products processed so as to largely inactivate or bind the

free gossypol which is normally considered to be toxic. UNICEF and FAO are currently fostering food development and acceptability studies with cottonseed flour in Peru, Pakistan, Egypt, Turkey and Iraq, which will hopefully lead to local production and expanded use of this protein concentrate.

The possibility of producing low-cost stable, bland, deodorized fish flours from whole fish in various parts of the world to provide a highly nutritious protein supplement for calorie-rich staples such as bread and noodles is now very real. Thus UNICEF has recently assisted the Government of Chile to bring into production a plant delivering about one ton of fish flour per day. This product contains about 80% protein and thus has excellent nutritional value. FAO has been assisting the Government of Morocco in the market promotion of a similar product produced in that country. The chemical and nutritional characteristics of several defatted, deodorized bland fish flours as produced from whole fish in Morocco, Sweden and Chile, are shonw in Table 8. Similar products have also been made in South Africa, Canada and the United States.

Table 8. Characteristics of some defatted bland Fish Flours

	Morocco	Sweden	Chile 1	Chile 2	Chile 3	Chile 4
Moisture, %	5.3	3.4	8.2	5.9	7.6	5.0
Protein (N x 6.25), %	81.4	86.3	79.8	80.4	78.6	81.6
"Fat"						
by Acid hydrolysis %	2.6	3.6	2.5	3.0	3.1	1.6
Ethanol extractables %	-	2.5	1.3	2.1	1.8	1.6
Ash %	12.8	13.4	14.7	16.8	16.5	18.1
Acid-insoluble ash, %	-	0.1	0.2	0.3	0.2	0.2
Crude fibre, %	-	0.4	0.4	-	-	-
Fluoride, p.p.m.	-	-	150.0	-	201.0	-
Lysine						
Total, % of protein	-	-	8.8	-	9.0	-
Available, % of protein	9.0	6.9	7.9	7.7	8.0	7.5
Nutritive value of protein						
P.E.R. *	2.7	-	3.0	2.7	-	2.8
N.P.U. **	72.0	-	79.0	79.0	74.0	80.0

* Protein Efficiency Ratio
** Net Protein Utilization

UNICEF is currently fostering technological studies aimed at the recovery of sanitary, protein-rich flours from sesame, sunflowerseed and cocomut. These latter studies are not as far advanced as those of other oil-bearing protein-rich seeds, nevertheless there is good reason to expect the early development of practical manufacturing technology for these products. An example of a protein-rich cocomut flour produced by screw-pressing is shown in Table 9.

Table 9. Composition of Screw-Press produced, defatted Coconut Flour

	%
Moisture	5.3
Fat	10.1
Protein (N x 6.25)	18.8
Ash	5.2
Crude fibre	9.4
Carbohydrate	51.2

Headquarters staffs of UNICEF, FAO, WHO as well as their field representatives are always pleased to receive enquiries from representatives of Governments and industry, as well as from scientists, clinicians and voluntary agencies, for further information about this new programme. Co-operative efforts to bring into regular dietary use many of the existing protein materials currently unavailable as food can go a long way towards solving protein deficiency problems in many countries, and may also be useful in meeting the food needs of the world's rapidly growing population.

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UTILISATION OF UNUSED PROTEIN RESOURCES FOR HUMAN FEEDING

by
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Dietary protein deficiency is a growing problem in a number of developing countries, particularly those in tropical and sub-tropical areas, where population is increasing rapidly and protein food resources are meagre. Prolonged malnutrition experienced early in life, and particularly protein deprivation, may cause irreversible impairment to human physical and mental fitness with cumulative detrimental effects on the vigour and productivity of populations. Since protein malnutrition affects most seriously infants, children and pregnant and lactating mothers, the United Nations agencies, WHO, FAO and UNICEF, are sponsoring a programme of technical and material assistance to governments to meet this need. To supplement milk supplies and to provide long-range answers to this problem, increasing emphasis is being given to the utilization of economical local protein resources which have not been employed to any significant extent in human feeding. These include cottonseed, peanut, soybean, sesame, coconut and fish flours. Some of these products are already in use in mixed protein-rich foods.

Current programme emphasis in a number of countries is on recipe development, product formulation, and acceptability testing of protein-supplemented mixtures to suit specific local food tastes. In the technological sphere, the work involves testing and evaluation of new foods, development and formulation of food quality and processing guides, and sponsorship of training programmes for individuals involved in national schemes for development and production of protein-rich foods. UNICEF and FAO are now co-operating with the governments of several developing countries in the installation of suitable processing facilities adapted to their technological needs and food habits, as well as in efforts to promote popular acceptance of these new foods.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: C.6.4

Austria

CONSIDERATIONS ON FOOD INSPECTION IN DEVELOPING COUNTRIES

By Fritz PETUELY, Ph.D., M.D.,
University Lecturer

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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CONSIDERATIONS ON FOOD INSPECTION IN DEVELOPING COUNTRIES.

by Fritz PETUELY, Ph.,D., M.D., University Lecturer.

INTRODUCTION

1) When instituting food inspection in a developing country, especially where there is a tropical climate, it is essential to view the infections transmitted by foodstuffs at the execution of the control of these foodstuffs. The next point would be the adulteration of the main foods being injurious to health (i.e. mineral oil for edible oil). Besides that, it is important to note the food-poisonings by cereal fungi like ergot of rye and maize smut which had been of importance in Europe, as is well known, until last century. Only in the third place it seems to be important to prevent the serious adulterations of foodstuffs being injurious to health - as they have been observed also in Europe in previous centuries - especially in developing trades. Finally, the last stage of the establishment of a control of foodstuffs would be the examination of foodstuffs for unsoundness and certain characteristics of quality, as carried out in the European countries.

2) The legal bases for food inspection in developing countries: in order to carry out the specified analyses, it is necessary to establish and to realize a corresponding law on foodstuffs. Unlike the Austrian law on foodstuffs, such a law should clearly cover all the measures of control and should also specify all the methods in a book of methods in order to prevent a superficial and irrelevant procedure of control. That is to say that, corresponding to the classification of the World Health Organisation for the infections communicable by foodstuffs, there should be established a basis for the examination and also a basis for the control similar to the Austrian law concerning communicable diseases and the law regulating periodic investigations for enteric pathogens in persons dealing with victuals in particular. Such a law should include the infections communicable by foodstuffs. These are :

a) communicable diseases:

i) bacterial infections: typhoid fever, paratyphoid fever, infections with salmonella, dysentery, streptococcal sore throat and streptococcal scarlatina, diphtheria, brucellosis, tuberculosis and tularaemia.

ii) Viral and rickettsial infections.

iii) Protozoal diseases.

iv) Zoonoses.

The infections mentioned under a) i and ii might fall within the scope of a general control of health and in this way it would not be necessary to deal with them in the control of foodstuffs: streptococcal sore throat and streptococcal scarlatina, diphtheria and tuberculosis, viral and rickettsial infections. A law on foodstuffs, therefore, should comprise the following diseases: typhoid fever, paratyphoid fever, salmonelloses, dysentery, brucellosis and tularaemia, protozoal diseases, zoonoses, botulism, food-poisoning by staphylococcal enterotoxin.

3) For the control of the diseases communicable by foodstuffs, it would be necessary to establish on the basis of the law a police-organisation for foodstuffs which should be entitled to take samples and also to take samples of water in all enterprises producing foodstuffs and in all groceries, as determined by the Austrian law on foodstuffs. These police-organs for foodstuffs should be defended against attack as they might occur in less enlightened classes of population. That means, that they should have real police-power with all rights resulting from them, similar to the police-organs for foodstuffs in the Netherlands. Regarding an efficient combat against infections, they should also have the right to control not only the foodstuff industries as provided by the Austrian law on foodstuffs, but also foodstuff-production on farms, etc. It would be suitable to give the functions of sanitary police also to these police-organs and to charge them with the control of drinking water.

4) Besides the right to take samples, the law on foodstuffs should include also the right of sanctions. These sanctions should be divided into delicts of negligence and deliberate delicts providing the possibility of warnings to be given by the police-organs for foodstuffs or their superior authority as an instructive measure.

5) Besides that, the law on foodstuffs should contain the institutions for the analyses of foodstuffs. Later this point will be discussed in detail.

6) <u>Emergency programme for the establishment of a control of foodstuffs</u>: within the frame of an emergency programme, there should be established institutions for analyses. At first, one institution would be sufficient for a population of 3 - 4 millions. Above all, such an institution should have bacteriological equipment for the analyses of foodstuffs and a bacteriological specialist should be engaged to deal with food-bacteriology and food-epidemiology respectively. In the second place only, it would be necessary to employ chemists. The reason for this kind of equipment of these institutions for analyses is the importance of this activity in order to prevent epidemic diseases communicable by foodstuffs. Chemical analyses of foods will not be of such a comprehensive significance, except i.e. cornutism, ustilaginism, mineral oil to edible oil, etc. For the bacteriological analysis of foods, it would be necessary to engage food-bacteriologists trained abroad and two physicians; one of them should be the director of the institute for analyses. 6 qualified medico-technical lady-assistants specially trained in food-bacteriology should be at the disposal of these two physicians. For the chemical analyses of foodstuffs it would be sufficient to engage one or two food-chemists with three or four medico-technical lady assistants

7) As for the equipment with appliances of an institute of this kind the need of them would prove itself automatically by the volume of analytic problems to be carried outin the field of bacteriology. For the execution of chemical tests it will be sufficient to provide for standard equipment, whereas there will be no need of special instruments, such as spectrophotometers, gaschromatographs, etc.

8) In the first place, the chemical tests of the institute should cover especially the chemical analyses of water; besides that, the analyses of adulteration of main foodstuffs, such as chemical control and control of weight of bread and corn, the analyses of milk and milk-products for dilution and skimming, analysis of fat and particularly of oils for the

addition of deleterious substances as mineral oils, etc. As for the examination of fruit and vegetables, it would be necessary to provide a microbiological control for contamination of vegetables by metazoic parasites causing diseases in man.

9) At any rate, the food-police should be subordinated to the control of the institute for analyses as practised in the Netherlands. The director of this institute should be, therefore, also chief of the food-police. By these means only, it would be possible to carry out a suitable and independant food-stuffs control and prevent diseases communicable by foods. Therefore, it would be indispensable that the foodstuffs-control should be independant of local influences and it should be subordinated directly to the control of the government of the country. The chief of the foodstuffs-control should be vested with extraordinary powers regarding his actions and in case of need, he should be authorised to call on the executive power for assistance.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: C.6.4

Austria

CONSIDERATIONS ON FOOD INSPECTION IN DEVELOPING COUNTRIES

By Fritz PETUELY, Ph.D., M.D.,
University Lecturer

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CONSIDERATIONS ON FOOD INSPECTION IN DEVELOPING COUNTRIES

By

Fritz PETUELY, Ph.D., M.D.
University Lecturer

S U M M A R Y

1) In developing countries food inspection must deal especially with epidemic diseases transmitted by foods. Therefore, it is indispensable that the emergency programme should provide in the first place for bacteriological analyses.

2) The chemical analyses of foods within the framework of the emergency programme should cover in the first place unhealthy admixtures which are to be feared in large amounts.

3) At first, it would be sufficient to establish an institute for analyses with three or four laboratories, one of them should deal with bacteriological tests, and it would be necessary to engage two physicians and one or two chemists with their assistants. One institute would be sufficient for a population of 3 - 4 millions.

4) The food-police should cooperate closely with the institute for analyses and the director of this institute should also be the chief of the food-police. The food police-organs should have real police-power.

5) A law on foodstuffs should take into account particularly food-epidemiology and it should contain all the bases for food inspection and also sanctions in case of violation of the law. A book of methods should be attached to the law, similar to the Dutch Warenwet.

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CONFÉRENCE DES NATIONS UNIES
SUR L'APPLICATION DE LA SCIENCE ET DE LA TECHNIQUE
DANS L'INTÉRÊT DES RÉGIONS PEU DÉVELOPPÉES

Point de l'ordre du jour : C.1.3

Sénégal

LES ACTIONS DE PREVULGARISATION AU SENEGAL

Par B. RUYSSEN,
Ingénieur de Recherches,
I.R.A.T. - C.R.A., BAMBEY

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

LES ACTIONS DE PREVULGARISATION AU SENEGAL

par B. RUYSSEN
Ingénieur de Recherches
I.R.A.T. - C.R.A. BAMBEY

-:-:-:-:-

1 - ORIENTATION DE LA RECHERCHE AU C.R.A. de BAMBEY

2 - NECESSITE DE FAIRE PASSER LES RESULTATS DE LA RECHERCHE DANS LE DOMAINE DE LA PREVULGARISATION ET CREATION DE LA SECTION D'APPLICATION DE LA RECHERCHE A VULGARISATION (S.A.R.V.)

3 - METHODE A EMPLOYER DANS LA PRATIQUE POUR METTRE LES RESULTATS DE LA RECHERCHE A LA DISPOSITION DU CULTIVATEUR,

4 - PLANS DE PREVULGARISATION ET PROTOCOLES D'ESSAIS DE DEMONSTRATION EN MILIEU RURAL TRADITIONNEL.

5 - ACTIONS DIVERSES, PROPAGANDE .

-:-:-:-:-

1) a - La Recherche agronomique au Sénégal a pour rôle de préparer les solutions techniques nécessaires à l'augmentation de la production agricole dans le cadre du plan national de développement; elle se préoccupe de façon constante des conséquences économiques de ses travaux et tient compte dans ses propres objectifs, de ceux du Gouvernement.

b - Les résultats de la recherche ont des répercussions au niveau des objectifs de développement car ils conduisent à proposer des méthodes culturales améliorées, des variétés sélectionnées, des formules de fertilisation dont l'application chez le cultivateur a une incidence immédiate sur l'économie de la région intéressée; améliorer la qualité des produits, augmenter la production en maintenant la fertilité des sols représentent l'aspect économique fondamental des travaux de recherche; mais cet objectif à court terme est assorti d'objectifs à longs termes correspondant aux besoins à venir en harmonie avec les plans de développement, ils demandent des études préparatoires des expérimentations que l'organisme de recherche a pour mission de poursuivre.

2) a - Les agronomes après avoir mis au point de nouvelles techniques culturales, doivent également mettre au point les moyens de les réaliser; il importe en recherche appliquée de ne pas dissocier ces recherches de leurs attaches fondamentales, la technique agronomique, l'adaptation locale; il faut éviter que se crée un hiatus entre organisme de recherche et organisme de production; une section de liaison doit donc jouer le rôle d'introduction des résultats de la recherche pour les faire passer au stade de la vulgarisation.

b - Cet organisme de liaison a été créé au C.R.A. de Bambey en 1961, afin de supprimer définitivement les inconvénients que présente l'individualisation obligatoire des services de Recherche, c'est la Section d'application de la Recherche à la Vulgarisation (S.A.R.V.).

Son rôle est double, connaissance du milieu d'application, c'est-à-dire établir un courant de la vulgarisation vers la Recherche; c'est la Section d'Economie Rurale; en même temps établir un courant de la Recherche vers la Vulgarisation, c'est la Section de Prévulgarisation.

c) Le rôle de cette Section de Prévulgarisation est de faire la synthèse des résultats de la Recherche mis en lumière par la Section des Techniques Culturales du C.R.A. pour dégager la solution convenant à chaque cas particulier et concilier la recherche et la pratique; elle prépare et facilite la vulgarisation en lui apportant les éléments techniques d'information susceptibles de guider le choix des objectifs à atteindre et des moyens à mettre en oeuvre.

d) Il est nécessaire d'éviter les déceptions résultants d'une application incomplète ou inconsidérée des techniques nouvelles préconisées.

Les résultats de la Recherche sont triés et assemblés pour devenir un ensemble de solutions techniques réalisables dans les conditions locales. La Prévulgarisation devra donc à la fois mener l'expérimentation à son terme ultime (essais d'adaptation locale ou de confirmation dans les différentes zones écologiques) et être en relation constante avec les services de Vulgarisation.

e) On réduira ainsi le goulot d'étranglement entre la recherche et l'application en milieu rural en assurant un contact souple paysan-chercheur. Le chercheur ne peut en effet qu'avoir des contacts occasionnels; avec le paysan, celui-ci de son côté ne recherche pas systématiquement le contact avec le chercheur, il n'en éprouve pas le besoin; il est donc nécessaire que la SARV pousse jusqu'au stade de la prévulgarisation en milieu rural et provoque la prise de conscience par le paysan des moyens techniques

mis à sa portée.

f) Cette prise de conscience , cette transformation des habitudes du paysan constitue une révolution que l'animation Rurale contribue à préparer; la prévulgarisation trouvera un terrain préparé, un état réceptif chez le paysan dans la mesure où l'animation rurale sera passée par là.

3) a - Selon les objectifs actuels du plan de développement les résolutions du Comité local de Recherche, les résultats de la Recherche transposables en milieu rural, la SARV propose l'implantation d'essais démonstratifs de techniques culturales ou de secteurs pilotes.

b - Il s'agit d'apporter au service agricole des éléments techniques lui permettant de mettre en oeuvre les moyens pratiques de propagande et de démonstration; les essais démonstratifs sont mis à la disposition des agents chargés de la vulgarisation au premier échelon et de l'application des protocoles.

c - Les études poursuivies au C.R.A. permettent depuis déjà plusieurs années et au fur et à mesure du contrôle des résultats obtenus, de mettre à la disposition de l'agriculture Sénégalaise un certain nombre de techniques agronomiques éprouvées.

d - De nombreux essais, mis au point, suivis et interprétés sont implantés dans les stations régionales et un réseau d'essais multilocaux (192 essais auprès de 57 localités en 1962) vient constituer la dernière approche avant la vulgarisation et assurer la diffusion des techniques agronomiques dans le milieu traditionnel.

e - La Vulgarisation rencontre certaines difficultés, dues d'abord à la structure agraire et à la tenure foncière; la culture itinérante est liée au système encore actuel où la famille n'a qu'un droit d'usage sur la terre; ce système n'incite pas le paysan à se donner du mal pour améliorer une terre qui ne lui appartient pas et qu'il ne sera pas en droit de laisser à ses descendants.

f -La sédentarisation des cultivateurs qui représente la majorité des cas ne contribue pas suffisamment à pallier les coutumes de tenure des terres.

Un autre obstacle réside dans le revenu très bas des producteurs ruraux; faute de possibilité d'épargne l'accès direct au crédit leur est fermé car l'absence de garantie s'oppose au crédit normal.

On ne peut demander au cultivateur des dépenses supplémentaires qui l'éloignerait aussitôt des techniques proposées; la politique de l'aide entièrement gratuite n'aboutit finalement pas plus au but cherché et dès que l'aide cesse toute l'action entreprise est effacée, c'est par la création des coopératives que le cultivateur pourra bénéficier du crédit pour son équipement, celles-ci faisant le relai avec les Banques de développement et couvrant le particulier de sa responsabilité solidaire; les coopératives représentent une chaine de relais entre la direction de l'Economie et le niveau du cultivateur en faisant passer l'économie de traite à l'économie de marché elles contribuent à l'entrée de l'agriculteur dans une économie stable car elle apporte un élément de consolidation et d'équilibre à une structure rurale qui tend à se désagréger.

g - Le développement agricole dépend donc de la mise en oeuvre conjointe de la vulgarisation, de la coopérative du crédit agricole.

h - Un autre facteur limitant réside dans le manque de densité de l'Encadrement rapproché, on ne peut s'assurer l'adhésion du cultivateur que par contact approché encadreur-paysan; là encore l'animation rurale joue un rôle important par son contact permanent qui se traduit par un ensemble de petites interventions répétées au niveau du cultivateur et avec les moyens dont il dispose.

4) a - Les objectifs étant définis un programme Prévulgarisation a été établi au niveau Ministère, au cours de réunions de travail groupant les représentants de l'Economie Rurale, la Direction des Services agricoles, les Inspections régionales, les chercheurs du C.R.A.

b - Les conditions d'implantation et ces points d'implantation furent choisis en fonction d'une part du personnel en place dans les secteurs et d'autre part des études d'économie rurale entreprises par les Services agricoles; les méthodes d'enquête, de recensement, de sondage sont de leur ressort; la connaissance de base sur la structure économique des exploitations agricoles est nécessaire à l'élaboration d'une doctrine de vulgarisation valable pour des ensembles homogènes; on ne peut se contenter de faire sauter un "goulot", il est essentiel que le plein emploi rural se traduise par une mise en valeur totale des terres disponibles grâce à un équipement suffisant; si le goulot "semis" est supprimé grâce au semoir, il subsistera le goulot "binage", si celui-ci est supprimé grâce à la houe attelée il restera le goulot "arrachage" etc...; l'amélioration de l'agriculture doit être fondamentale et non une addition d'améliorations partielles ne modifiant pas sa structure.

c - Il fut tout d'abord établi que les champs de démonstration devaient être faits chez le cultivateur et par le cultivateur lui-même, si le paysan n'a pas toujours pris conscience des résultats des essais multilocaux entrepris à côté de lui c'est qu'il n'y participait pas ou peu; il convient évidemment de ne vulgariser que des essais parfaitement démonstratifs dont les résultats ont été abondamment éprouvés en Station; ils doivent avoir un effet très net sur les rendements, être suffisamment au point pour que l'on soit sur des résultats escomptés, être d'exécution facile, ne pas occasionner une trop forte augmentation de travail de la part du cultivateur choisi ni une augmentation de dépenses; le choix de la plante porte sur les cultures traditionnelles, les cultures de diversifications venant ensuite mais dans la limite des plantes déjà connues.

d - Les thèmes de vulgarisation portent sur :

- l'amélioration quantitative de la production par : les techniques culturales, l'outillage, la fumure.
- la permanence de la fertilité par : le travail du sol
  les rotations.
- l'amélioration qualitative de la production par : la qualité des semences, les traitements fongicides la défense des cultures, la conservation.
- la commercialisation, la préparation des produits -

e - Les essais d'avant garde faits en ordre un peu dispersés ont été remplacés par des séries d'essais systématiques basés sur un plan d'ensemble, et sur la normalisation des techniques et des protocoles. Ce plan a été concrétisé par l'établissement d'un réseau d'Unités régionales d'expérimentation multilocale, (U.R.E.M.) une par région agricole appuyé sur une station existante (C.R.A. ou agriculture), complété par région par des points d'appui d'expérimentation multilocale (P.A.P.E.M.)sous la responsabilité des chefs de Secteurs agricoles.

f - En ce qui concerne les techniques culturales deux séries d'essais furent retenues,

une très simple destinée à l'implantation chez le cultivateur et faite par le cultivateur; elle comporte plusieurs traitements allant du champ traditionnel au champ préparé et cultivé avec des méthodes améliorées; les 4 traitements suivants sont proposés, réalisés sur de petites parcelles de 10 x 50 mètres; cette année l'essai porte uniquement sur le mil (ou le niébé suivant la région) de façon à faire revenir le paysan sur son indifférence aux soins à apporter à la culture du mil .

1- Culture traditionnelle
2- " " + engrais N P K
3- Travail du sol + engrais N P K
4- Travail du sol + fumier
+ engrais N P K
+ phosphatage de fond

g - Ces 4 traitements sont faits en 2 séries parallèles, une sur mil de sélection, une sur mil local .

Le C.R.A. fournit le protocole et les engrais minéraux, l'implantation est réalisé par l'agent de l'agriculture chez un cultivateur avec les moyens du cultivateur.

h - une autre série d'essai un peu moins simple est réservée aux abords des stations ou à des cultivateurs déjà évolués.

La démonstration repose sur l'amélioration foncière et la rotation en culture permanente; il s'agit de faire ressortir auprès du cultivateur la possibilité de maintenir et même d'améliorer en permanence la fertilité des terrains par des méthodes culturales à la portée de tous cultivateurs possédant du petit matériel de culture attelée.

Ce dispositif comprend 4 parcelles représentant une rotation quadriennale avec :

1 parcelle repos (jachère enfouie)
1 -"- arachide (ou niébé)
1 -"- mil (ou sorgho)
1 -"- arachide (ou niébé)

Sur chaque parcelle 5 traitements sont prévus

1 culture traditionnelle
2 " " + engrais annuel
3 " " (+ phosphatage de fonds (+ engrais annuel
4 culture améliorée + engrais annuel
5 " " (+ engrais annuel (+ phosphatage de fond (+ fumier

i - Cette formule de rotation longuement éprouvée au C.R.A., puis en stations et en essais multilocaux représente un stade de culture évoluée, parfaitement adaptée au milieu du paysan Sénégalais et pouvant être appliqué immédiatement, sans paliers intermédiaires.

Cette rotation avec engrais accompagnée d'un travail du sol soigné avec les outils maintenant abondamment vulgarisés peut entrer dans les habitudes sans moyens financiers spéciaux et transformer l'agriculture précaire et itinérante en une agriculture stable et rentable.

j - Ces systèmes de culture, tout en assurant une rentabilité immédiate plus grande, entrainent un relèvement progressif du niveau de fertilité des sols; qui doit permettre dans un délai rapproché de sortir du cycle arachide-mil pour introduire des cultures actuellement impossibles parce que plus exigeantes (sorghos hybrides, maïs, coton, tabac) et, donc de diversifier la production vers des produits agricoles plus riches ou plus demandés.

k - Pour entrer dans la vulgarisation elle même qui n'est pas du ressort de la Prévulgarisation, il convient de s'adresser aux structures d'accueil existant dans le milieu rural, Centres Régionaux d'assistance pour le développement (C.R.A.D.), encadrement, animation; les essais ne sont plus expérimentaux mais démonstratifs et directement applicables et transposables en milieu rural; les résultats en sont exploités directement par la SARV et communiqués à la Recherche.

5) a - En dehors des techniques culturales proprement dites, la Section Prévulgarisation de la SARV doit assurer par ses relations avec les services extérieurs la divulgation de tous les résultats de la Recherche trouvant une application directe au niveau du cultivateur; principalement en ce qui concerne le machinisme agricole, les méthodes et produits de traitement des récoltes, les appareils tels que le moulin à mil, mis au point au C.R.A. Une action particulière de la SARV, déjà lancée depuis de nombreuses années consiste à fournir chaque année aux Services agricoles et Coopératives un tableau complet de la valeur culturale et de la pureté variétale des semences d'arachides stockées par les organismes collectifs; ces analyses portent sur la totalité (500 au Sénégal) des organismes distributeurs de semence; selon le résultat les semences sont conservées ou renouvelées.

b - La diffusion des travaux et résultats de la recherche se fait sous une forme simple par l'intermédiaire des S.A. locaux, on cherche à unifier les méthodes d'expérimentation et de démonstration. Les contacts sont cherchés avec l'encadrement; les agents sont invités avec les cultivateurs à des visites de démonstration de pratique agricole dans les centres et stations; des stages sont effectués au C.R.A. par les futurs moniteurs d'agriculture sortant des écoles régionales. Enfin la propagande par la presse et la radiodiffusion fait l'objet d'une

collaboration très étroite avec la Direction de l'Agriculture, et le Ministère de l'Information; un programme de conférences à la portée du cultivateur est diffusé régulièrement pendant la campagne agricole; selon l'époque les sujets traités correspondent aux activités agricoles du moment (semis, entretien des cultures, fumure, récolte)

c - Les nombreux postes individuels et les postes d'écoute collectifs des villages assurent une large diffusion à ces émissions essentiellement pratiques (en français et en langues vernaculaires).

Enfin, un manuel simple d'agriculture pratique destiné à l'encadrement de base est en préparation./

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ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: C.1.3

Senegal

PRE-POPULARISATION WORK IN SENEGAL

By B. RUYSSEN,
Research Engineer,
I.R.A.T. - C.R.A., Bambey

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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PRE-POPULARISATION WORK IN SENEGAL

By
B.RUYSSEN
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1. DIRECTION TAKEN BY RESEARCH AT BAMBEY C.R.A.

Research results have repercussions on development targets; their application by farmers has an immediate incidence on the economy of the area in question. Agronomic research in Senegal constantly takes into account the economic consequences which it entails.

2. NEED TO PUT THE RESULTS OF RESEARCH INTO PRACTICE

When new techniques have been evolved, it is important to provide the means of putting them into practice and adapting them to the farmers' means.

A liaison body was set up in Bambey in 1961, the Department for Application of Research to Popularisation (S.A.R.V.). Its role is to summarise research results in order to select the solutions suited to each individual case and reconcile research to practice.

3. METHOD FOR MAKING RESEARCH RESULTS AVAILABLE TO FARMERS

S.A.R.V. must simultaneously carry experiments to their logical conclusion and maintain constant contact with popularisation services; it goes up to the pre-popularisation stage in rural areas and informs country people of the technical means available; it suggests the planting of trial grounds demonstrating cultivation techniques or pilot areas.

Numerous trial grounds, prepared, followed up and interpreted, have been planted at the Regional Stations, and a trial system operated in a number of areas constitutes the final approach before popularisation; it ensures dissemination of techniques in traditional surroundings.

Some difficulties are encountered, primarily because of the agrarian structure and to the system of land tenure, and secondly because

of the very low income of rural producers and the resultant difficulties in obtaining direct access to credit.

Agricultural development thus depends on the joint functioning of popularisation, co-operation and agricultural credit; it also depends on sufficiently close supervision.

4. PRE-POPULARISATION PLANS AND PROCEDURES FOR DEMONSTRATION TRIALS IN TRADITIONAL RURAL SURROUNDINGS.

The aims having been defined, a programme has been drawn up at Ministerial level by representatives of the Rural Economy, Agricultural Management, Regional Inspectors and the C.R.A.

Planting sites were chosen on basis of the personnel available there and the studies on rural economy undertaken by the Agricultural Services.

It was decided that the demonstration grounds must be on the farmer's land and planted by the farmer himself, to give him a direct interest in the matter.

Popularisation programmes relate to:

Improvement in quantity produced,

permanent fertility,

improvement in quality,

protection of crops and livestock,

marketing and preparation of produce.

Two series of trials were suggested: a very simple one dealing only with millet (soil cultivation, density, organic and inorganic fertilisers) and a more complicated one comprising four-yearly rotation with different degrees of inorganic fertilisation.

5. MISCELLANEOUS WORK, PROPAGANDA

Publication of results in simple form by local Agricultural Services.

Contacts with personnel and supervisors,

Training of instructors at the C.R.A.,

Demonstration of dultivation and machinery techniques,

Press and radio propaganda,

Preparation of a simple manual on practical agricultural methods for use by field supervisors.

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CONFÉRENCE DES NATIONS UNIES
SUR L'APPLICATION DE LA SCIENCE ET DE LA TECHNIQUE
DANS L'INTÉRÊT DES RÉGIONS PEU DÉVELOPPÉES

Point de l'ordre du jour : C.4.1

Côte-d'Ivoire

LA SELECTION DU COCOTIER EN COTE-D'IVOIRE

Par Y. FREMOND,
Chef du Secteur Cocotier à l'I.R.H.O.

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

LA SELECTION DU COCOTIER EN COTE D'IVOIRE

Y. FREMOND

Chef du Secteur Cocotier à l'I.R.H.O.

INTRODUCTION.

La sélection sur le cocotier en Cote d'Ivoire débutée il y a 10 ans par la Station Expérimentale I.R.H.O. de PORT-BOUET a largement utilisé les recherches effectuées depuis 50 ans en Inde et à Ceylan plus spécialement.

Toutefois si les principes généraux restent les mêmes que partout ailleurs dans le monde, certains caractéristiques du cocotier africain lui confère une originalité propre.

Ces caractéristiques sont les suivantes :

- Introduction récente, de l'ordre de 300 ans et réduite en nombre égal.
La diversité des types et la variabilité génétique sont faibles.

- A l'opposé du type polynésien banal (petit nombre de noix à coprah élevé) le typica africain se caractérise par un grand nombre de noix à bourre assez épaisse, un nombre de fleurs femelles assez élevé, une précocité moyenne, des régimes a rachis long. l'arbre lui-même est relativement peu développé = stipes grèles, pétioles courts, fort espacement entre les feuilles de la flèche (lié à pétiole court) d'où une floraison basse, etc...

- En outre le peu de diversité des types, conséquences de la faiblesse des effectifs introduits, s'est trouvée accentuée, l'extension des cocoteraies s'étant faite de proche en proche. A cela s'ajoute une pollinisation entomophylle peu dispersée, un arbre est surtout pollinisé par ses voisins.

A la pauvreté génétique originelle s'est donc ajouté un coefficient d'indreeding élevé, accentué encore par un mode de croisement non rigoureusement au hasard.

1) - MATERIEL DONT DISPOSE LA STATION EN COTE D'IVOIRE.

- ARBRES AKABO. Sélectionnés sur le critère nombre de noix = X 3 ans = 59 noix/an.

- ARBRES MENSAH. Population de 600 arbres, moyenne de noix 55, -52 %, moyenne coprah par noix 160 grs, -CV 12,5 %. Sélection sur Forte production en nombre et coprah par noix.

En outre une étude d'association de caractère et de correlation est effectuée sur ces arbres et sur leurs descendants.

INTRODUCTIONS. Typica Dahomey, Cameroun, Ceylan, Cambodge, Mozambique, Malaisie, Polynesie, etc... Nana Ghana, Malaisie, Brésil.

II - PRELIRS RESULTATS.

Production cumulées à 9 ans.

Origines	Coprah/Noix	Coprah total	Equivalence Ha. 160 arbres.
Locales	159 grs	19,039	3 046 kgs
Cameroun	143	19,501	3 120.
Dahomey 1	172)	23,295))	3 727)
2	164) 175	23,507) 22 561	3 761) 3.610
3	190)	20 885)	3 342)
Geniteurs retenus (moy.)	214	43 960	7 033

On en déduit : - La supériorité du matériel Dahoméen sur le matériel local Cote d'Ivoire en coprah par noix et en copreh total.

- La faiblesse de l'origine Cameroun en coprah par noix.

- Le niveau des critères utilisés pour choisir les arbres destinés à la poursuite de la sélection.

III) - LE PROGRAMME DE SELECTION EN COURS DE DEVELOPPEMENT.

La production en coprah total étant la résultante d'une série de facteurs, chaque arbre observé est caractérisé pour chacun de ces facteurs. Les uns tels le coprah total, le nombre de noix et le coprah moyen par noix constituent les caractères primaires de production. Les autres tels le nombre de régimes, le nombre de fleurs ♂, les rapports de fructification et de nouaison, les vitesses de croissance et de développement, la vitesse de germination des noix produites, etc... complètent secondairement la définition de chaque arbre.

A) - Les schémas.

(1) - Le matériel local, planté en champs généalogiques offre la possibilité de tester la valeur génétique des arbres-mères par l'étude de leur descendance, -donc de découvrir des sujets prépotents - et en outre permet de déclarer les meilleurs sujets au sein des meilleures familles.

(II) - LE MATERIEL EXOTIQUE

- Nana. Il servent d'une part à l'hybridation Nana X Typica (L'hybride est productif et précoce), de l'autre à isoler les combinaisons N X T particulièrement fructueuses en vue d'être repeté en Jardin Grainier à large échelle.

- Typica. Croisements compensés entre souches géographiquement éloignées à caractéristiques complémentaires dans le but de bénéficier du maximum de vigueur hybride et de combiner des caractères plus ou moins antagonistes (grand nombre de noix - gros coprah par noix).

- Nana X Typica. Etude de la disjonction FI X FI (N x T) X (N x T) et des back-cross (N x T) x N et (N x T) x T.

b) - LE PROGRAMME DE CROISEMENT

♀	♂
Typica local (A) Grand nombre de noix Petit coprah par noix Coprah total très élevé	Typica exotique (I) Coprah par noix moyen ✱ Coprah total élevé
	Typica exotique (II) Très gros coprah par noix ✱ Coprah total moyen
	Typica local (A)
Typica local (B) Nombre de noix moyen ✱ Gros coprah par noix ✱ Coprah total élevé ou très élevé.	Typica exotique (I)
	Typica exotique (II)
	Typica local (A)
Typica exotique très précoce (I et II)	Typica local (C) très précoce

C O N C L U S I O N.

La sélection du cocotier en Côte d'Ivoire achève le premier stade de l'analyse du stock génétique disponible. Elle aborde maintenant les stades de synthèse (croisements).

Les caractéristiques très accentués du matériel local par croisement avec des types exotiques opposés doit réussir à conjuguer forte production en nombre de noix et en coprah par noix.

Si dans le passé certains furent pessiniste, c'est sans doute parcequ'ils n'avaient pas des vues suffisamment larges.

✱ : Relativement à la souche.

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SUMMARY

Agenda Item: C.4.1

Ivory Coast

COCONUT PALM SELECTION ON THE IVORY COAST

By Y. FREMOND,
Chief of the Coco Palm Section
of the I.R.H.O.

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COCO-NUT PALM SELECTION ON THE IVORY COAST

by

Y. FREMOND
Chief of the Coco Palm Section of the I.R.H.O.

S U M M A R Y

1) IMPORTATION: The coco-nut palm is of very ancient culture. Its selection had been empirical for a long time. For the last 30 years, however, it has been studied in research stations in the Far East and the Pacific, then, much later, at I.R.H.O. station Port Bouet, Ivory Coast.

a) Origin of the West African coco-nut palm. It was imported 300 years ago by Portuguese sailors from Tropical Africa. Its genetic power is low (frequently recessive characteristics appear, there is a total lack of different forms or Asian varieties.)

b) The West African coco-nut tree is of the following types :

- Typica with bunches of nuts, small size nuts (New Hebrides)

- Typica - small number of big nuts (Polynesia). The West African coco-nut palm has the following characteristics : heavy nut producer, small nuts, high number of ♯ blossoms, thick copra; small-size, low-flowering tree.

c) Other important points : In Africa, pollinisation is entomophilous; the lightness of the winds (contrary to what is the case in Polynesia) does not encourage the cross-breeding of genotypes. In addition to original genetic deficiency, there is a large proportion of inbreeding.

2) STOCK AVAILABLE TO I.R.H.O. IN IVORY COAST :

a) - Akabo trees : chosen on the basis of nut-quantity
b) - Mensah trees : heavy nut producer
c) - Importations have been realized from Dahomey, Cameroon, Ceylon, Cambodia, Mozambique, Melanesia, Martinique and Tahiti.

3) RESULTS OBTAINED : Stock from Dahomey is superior to that from Ivory Coast. The quantity of copra per nut is inferior in nuts from 8 year old trees than in those from 7 year old trees.

4) SELECTION SCHEME :

a) - General : Production is calculated on the basis of the quantity of copra per nut and number of nuts (Number of leaves then number of ♯ blossoms through inflorescence.

b) - Methods of work : stock selection and cross-breeding.

i) local stock is used for progeny tests
ii) foreign plant stock comprises :

- The "Dwarf stock" which is used for production of seeds Nana x Typica and for certain cross-breedings Nana x Typica.

- The "Typica stock" : cross-breeding of local Typica (high number of small nuts) x foreign Typica (small number of big nuts) in order to obtain the highest possible number of big nuts.

5) CONCLUSION :

After introduction into Ivory Coast of foreign stock we are now beginning to make use of it. We still have to obtain the increase of copra per nut and a bigger number of nuts. Selective work is necessary in various directions by using the different possibilities of genetic varieties of the cocoonut palm.

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